

Global Warming in the Indian Context

An Introductory Overview

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This booklet is based on conversations with many people from different states, chats with fellow-activists, public meetings and talks, activist reports, state action plans on climate change, India's INDC and other government publications, EDGAR data, IPCC reports, books, and scientific papers. I have largely avoided giving references so it does not become academic. A list of published material and online sources are provided at the end.

The booklet is mainly aimed at college and university students and teachers in towns and cities, other young people, activists, and anyone interested in a basic overview. Its broad purpose is to urge greater engagement, whether individual or collective, with the issue of global warming. A few suggestions about what one could do are offered.

- Nagraj Adve
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What they told us in Gujarat

A few years ago, a group of us went to northern and eastern Gujarat to find out how climate change was affecting small farmers there. In villages in eastern Gujarat, they told us that the wheat and maize crops had been getting hit for some years during winter. Wheat and maize are important sources of nutrition for poor households in these and nearby regions. But because winters have been getting warmer, the dew (*os*) had lessened, or stopped entirely for the last few years. For those without wells—most of them poor households—dew is the only source of moisture for their crop. With less or no dew falling, either their crop dried up, or they were being forced to leave their lands fallow.

When we asked them why the winters had been getting milder, the people's response there was interesting: "*Prakruti ki baat hai* (it has to do with Nature)." They did not consider it imaginable that human beings had the power to alter Nature on this scale. We do.

The Earth's *razai* is getting thicker

Whenever we burn coal, gas, and oil—the fossil fuels that are the engine of all modern societies, now and for the last 250 years—the carbon in those fuels combines with oxygen in the atmosphere to form carbon dioxide (CO₂). Like oxygen, it is invisible; nor can it be smelt. Unlike oxygen, carbon dioxide has the capacity to absorb and trap some of the invisible heat radiation emitted by the Earth. There are other gases that do this, such as methane (from natural gas) and nitrous oxide (from fertilizers), but carbon dioxide is the most important because it lasts for tens

of thousands of years in the atmosphere. For that reason, and for simplicity, I will largely focus on carbon dioxide in this booklet.

Carbon dioxide though is not the villain; in fact, it is essential to life on Earth. Without carbon dioxide being naturally present in the atmosphere, the Earth would have been 30 degrees Celsius colder, and not habitable for humans. It is this presence of carbon dioxide that maintained temperatures which helped the growth of agriculture and the spread of human civilizations.

But we have been adding to the amount of carbon dioxide in the atmosphere. We dig coal, oil, and gas out from under the Earth, and burn these fossil fuels to run factories, make cement, drive cars, generate electricity and light up our homes, make steel, run ACs, fly planes, transport goods, fight wars. Some of this is essential activity, some socially wasteful, and some extremely damaging. In such activity, the world as a whole sent up 36 billion tonnes (1 tonne = 1,000 kilos) of carbon dioxide from burning fossil fuels and cement production in 2016, the latest year for which worldwide data is available [EDGAR data]. Another four billion tonnes of carbon dioxide got added by cutting forests and forest fires; when wood burns or rots, it emits CO₂.

The contribution of the other greenhouse gases is calculated as an equivalent of carbon dioxide in their capacity to cause warming. Methane's share is nine billion tonnes of CO₂-equivalent, and nitrous oxide and other gases, four billion tonnes. Hence a single year's emissions of greenhouse gases worldwide totalled 53 billion tonnes of CO₂-equivalent. And more, year after year.

Our rate of carbon emissions is far more than the Earth's natural capacity to absorb it. Since 1750, little over a quarter of all the carbon dioxide we emitted has been absorbed by the oceans; it has made their waters much more acidic. About the same amount has been taken up by trees, soil, and grass, etc on land. The rest—little under half—has remained in the atmosphere. In 2017, carbon dioxide levels in the atmosphere averaged **406 parts per million (ppm)**. It was 278 ppm at the start of the Industrial Revolution, and 315 ppm when daily records first began

to be maintained in 1958. It has not crossed 400 ppm for the last four million years.

Up there in the atmosphere, it acts like an invisible *razai*, or blanket. As we know, a blanket does not create its own warmth, it traps heat. Similarly, carbon dioxide, methane, nitrous oxide, and other greenhouse gases trap some of the invisible heat radiation emitted by the Earth, and hence cause global warming. Adding over fifty billion tonnes of carbon dioxide and other gases to the atmosphere each year is like adding layer after layer to the blankets we have already covered ourselves with. A thicker blanket traps even more heat.

The excess heat being trapped by these gases is so massive, it's equal to the energy of four Hiroshima nuclear bombs every second, 24 hours a day, 365 days a year. Over ninety per cent of it goes into the oceans, because water has a high heat absorption capacity. What's left melts the glaciers and ice, warms the soils, etc. Making the oceans warmer is disrupting the hydrological/rainfall cycle, makes cyclones more intense, and causes sea level rise.

Global warming is measured by taking the air temperature just above the land and ocean surface and seeing how it has changed over time. This is done at thousands of locations all over the globe, since 1880. **How much warmer has India become?** Average temperatures here have increased by about 0.8 degrees C since 1901. But the rate of warming has speeded up since 1981, and our average temperature is rising by 0.17 degrees C per decade. And this temperature rise is only an average; the Himalaya is warming twice as fast. And heat spikes and heat stress have become more common in a warmer India.

What about **the world as a whole?** Scientists compare current average temperatures with the baseline average of 1880–1920, a reliable substitute for temperatures at the start of the Industrial Revolution. The Earth is currently (in 2018), after accounting for short-term variability and natural fluctuations, **1.07 degrees Celsius warmer** than the pre-industrial average. Again, some regions and ecosystems, such as the Arctic, North

Africa, and southern Europe are warming a lot faster. These increases may not seem large, but planetary systems and many life forms are extremely sensitive to changes in temperature.

One crucial point here: all the warming does not happen as soon as carbon is sent into the atmosphere. There is a gap of many years between heat going into the oceans and the full surface warming it causes. Hence, some of the heat taken up by the oceans, a consequence of the billions of tonnes of greenhouse gases we have emitted over the last few decades, are yet to be felt. This unavoidable, further warming will be at least another 0.6 degrees Celsius, likely higher, over and above the current 1.07 degree C rise.

Who is responsible for global warming?

There are different ways of approaching this question. World over, by sector, the energy sector is responsible for 35% of greenhouse gas emissions, agriculture, deforestation, and forest fires 24%, industry 21%, transport 14%, and buildings 6%. If one includes the heat and electricity used by each sector (indirect emissions), the share of industry rises to 31%, and buildings to 19% (IPCC, *Synthesis Report 2014*, p 46). This sectoral data implies that we need to broaden our thinking and interventions to all transformations in all sectors, not just on coal/electricity/energy. Different systems need to change.

Another approach is: which areas are emissions coming from? Only 30 per cent comes from rural areas. As much as 70 per cent comes from urban areas, which tend to have a lot of wasteful consumption by the better-off, air-conditioning, malls, etc. For instance, over 35 per cent of electricity used in Mumbai is consumed running ACs, personal and commercial. Cities also have a lot of structures, which though used by most people, take a lot of resources and energy to build, such as bridges, Metros, flyovers, etc.

A third way—a very common approach—is to see **which nation is responsible** for how much emissions. China, at about 10.4 billion tonnes out of the total of 36 billion tonnes of CO₂ in

2016 [EDGAR data], has leapt way past the United States (5 billion tonnes). India at 2.5 billion tonnes is a distant third, followed by Russia (1.7 billion tonnes), and Japan (1.2 billion). The EU totals 3.4 Gt CO₂. Include methane and other gases, and India's total jumps to nearly 3 billion tonnes of CO₂-equivalent.

The US' and Europe's emissions per person though are a lot higher than China's or India's. It is even higher if one considers per capita emissions *based on consumption*. Taking imports into account, each North American currently emits each year on average 22 tonnes of greenhouse gases, a European 13 tonnes, an average Chinese 6 tonnes, and a person from South Asia 2.2 tonnes, compared to a world average of 6.2 tonnes (Chancel and Piketty). It is also higher if one were to consider the historical emissions of industrialized countries, what each country has emitted since the start of their industrialization.

Each of these frameworks has its merits, and would strengthen some of our demands, such as, say, that more public transport is necessary, or that rich, industrialized countries pay for the ecological damage they have caused. But they do not address issues at the heart of global warming. At the core of the problem are forces driving the modern capitalist economy, primarily the relentless quest for profits and growth. Also crucial are the growing differences in incomes, consumption, and wealth, in India and worldwide.

These factors have also caused a range of other ecological crises, both local (air and water pollution), and global, such as biodiversity loss, overfishing, deforestation, loss of species, resource depletion, plastic in the oceans, etc. Though our main concern in this booklet is global warming, all these crises have common roots.

The roots of the problem

The development of industrial capitalism powered by fossil fuels around the late 18th century marks a radical shift for what we are discussing.

One, in the use of energy sources. Although coal was used in

London and a few other cities for some centuries earlier, the scale of its use, with the spread of the industrial factory system in England in the late 18th century and the development of railways, was qualitatively different and massive. Emissions from oil began in 1870, and from gas in 1885; all these three fossil fuels—coal, oil, and gas—are very energy- and carbon-intensive.

Two, profits—from *anything*—became a primary driver. Corporations profit by using the cheapest sources of labour and raw materials. By making workers work for longer hours, and making them work faster. Companies also profit from exploiting Nature. They do so by gaining access and control over the commons resources used by and meant for everybody, such as forests, coastlines, the seas, and rivers, and by land grabs. It is not a coincidence that China became the biggest emitter of carbon dioxide in recent years. By the first decade of this century, manufacturing, urbanization, and other infrastructure had expanded massively in China, which has lots of coal and relatively cheap labour. By 2015, it was making a quarter of all the world's goods! Though this generated millions of stressful jobs, it came at a huge ecological cost, for Chinese people and for the world. But then corporations seek to *maximize* profit at any cost, the people and environment be damned.

Some of the surplus they extract is reinvested in the company to expand the business—buying new buildings, machines, computers. This accumulation, with the objective of making further profits, is a compulsion for all businesses. Because of competition, companies that do not do this would over time stagnate and close down, or be bought up by others. And because it is a compulsion, they can't stop trying to reinvest and expand. Maximizing profit, accumulation, and perpetually seeking growth are part of capitalism's DNA.

As a consequence, the world economy, which grew at barely 0.1 per cent a year for well over a thousand years before 1700, has grown much faster since. Economic growth—calculated for a state, country, or the world as a whole—is a rise or fall in output, value of service, or income over a period, usually a year. Inching

along for centuries before that, the world economy grew at 1.6% a year between 1700 and 2012, and in the last seventy years at over 3.5% a year (Thomas Piketty's data). In 1820, global output was 694 billion dollars, in 1917, it was 2.7 trillion (a thousand billion) dollars. By 1973, it had grown to 16 trillion dollars; by 2003, 41 trillion. In 2018, the world's annual GDP was over 84 trillion dollars (IMF data). It keeps ballooning, and in larger volumes. Keeping in step, half of all carbon dioxide emissions since the mid-18th century has occurred just since 1986.

World economic growth is currently 3% a year, and is expected to continue at approximately that rate for some years. Carbon emissions don't rise at the same rate as GDP; that depends on our energy mix of renewables and fossil fuels, and how efficiently our products and activity use energy. Over the past twenty-five years, CO₂ emissions for the world as a whole have risen 0.5 per cent for every one per cent rise in world GDP, that is, at half the rate of GDP growth. That improved in recent years as coal consumption slowed down in China, the US and other major economies use more gas, and the prices of renewables, particular solar power, fell sharply. Carbon dioxide emissions were flat for three years, raising illusions of a decarbonization of the world economy. But they rose again in 2017, and greenhouse gas emissions as a whole continued to rise throughout that period.

The science demands that emissions should fall sharply, by 6% each year, to reach safer levels in the atmosphere. However, worldwide economic growth, at 3% or thereabouts, would mean that overall greenhouse gas emissions will continue to rise, in spurts, particularly from the expanded use of oil and gas.

To sum up, the roots of global warming lie in the inherent drivers of the world economy — maximizing profits and growth. Those who see and discuss the issue only in nation-state terms or in other frameworks miss this underlying logic. Most public meetings I attend are silent about it. We can't hope to solve a problem if we have not defined it correctly in the first place.

Emissions, Unequal Consumption, and Wealth

How many gadgets does one use regularly at home? Does the house have a fridge, one AC, more than one AC? Do we take a bus, the metro, or drive a car? Our carbon emissions depend on all of these things. When going out of town, do we take the train, or fly? Say, if you took a train from Bombay to Delhi—1,384 kilometres—you would emit roughly 31 kilogrammes of carbon dioxide. In a plane, each passenger would emit over 150 kgs. And they would cause 13 times as much warming as someone taking the train, because planes emit condensation trails that trap even more heat.

All of this obviously depends on one's income and consumption, which are strongly connected. The huge differences of incomes and wealth in India have deepened over the last twenty-five years. There has been some improvement in the lives of sections of the poor either due to government policy (for example, the expansion or upgradation of the village road network by nearly 5,00,000 kilometres since 2001), or the spread of mobile phones, or the rise in agricultural wages until 2013, but this improvement has been partial and unequal. Incomes and consumption of the better-off have risen sharply, and there's been an explosion in the wealth of the very rich: 1% of Indians own 58% of the country's wealth, says a recent report. At the same time, the real wages of factory workers (after taking inflation into account) was 5% *lower* in 2014 than they were in 1996.

This deepening inequality is reflected in energy access and use. Though the number of households with access to electricity has risen in recent years, yet over 300 million people, including about 25 million in urban areas, don't have access to any electricity in their homes even now, and another 300 million get it for a scant few hours daily. This is despite the fact that India's electricity generation capacity has trebled over the past decade, to well over 3 lakh megawatts (3,46,048 MW as of 31 October 2018).

A colleague conducted workshops in colleges in Delhi on measuring how much carbon dioxide a household emits. With

his help in working through the numbers, we found that most of Delhi's middle class emits 4–5 tonnes of CO₂ per person a year; the rich households in India emit much higher, European levels. Factory workers and security guards earn Rs 7,000–8,000 a month. Domestic workers take home Rs 5,000–6,000. Agricultural workers' earnings are seasonal. How much carbon dioxide can they possibly emit?

Inequalities in emissions from current incomes and consumption are deepened by inequalities in emissions embodied in the products and property one owns. To take just two examples: in a car—which just 5% of India's population owns—3,500 kg of carbon dioxide are emitted just in making the aluminium that goes into the car, because the process is so energy-intensive. Or take a house. The larger or more *pucca* one's home, the higher the embodied emissions in it, because cement manufacture—like aluminium—is a huge source of carbon dioxide. And it has become common for the upper middle class or the rich in India to have at least two houses, one where they live and one more “in the hills”.

A nation-state framework of analyzing global warming chooses to ignore these huge internal differences of income and wealth. The stand of successive Indian governments has been that “India's per capita emissions are low”. It is hiding behind the poor. There is no one 'India'. In international negotiations, the government rightly argues for equity between nations. But the principle of equity should also apply within a nation, not only between nations. Greater equity implies that the rich in India should be made to consume less than they do, through higher income and wealth taxes, and a progressive carbon tax. That is one way there can be ecological space for the poor to improve their lives further. How we ensure that and yet generate decent work and employment for the millions of young people seeking jobs each year is a key question.

IMPACTS OF GLOBAL WARMING

Before we consider impacts in India and elsewhere, a few things are useful to keep in mind:

- Unlike most other forms of pollution, the source of carbon dioxide and where its effects are felt can be very far apart. Carbon dioxide generated in the United States affects the Maldives.
- A significant portion of carbon dioxide remains in the atmosphere for centuries. Also, climate change continues for a thousand years even after carbon emissions stop. Hence, climate change is here to stay. It is the new 'normal'.
- Impacts will worsen. Some of it is unavoidable. ***Our urgent intervention is needed to make sure they do not get much worse, and that the situation does not spiral out of our control.***

Major Impacts of Global Warming in India

Climate change adds on to all the other issues facing small and marginal farmers, the urban poor and other communities—higher costs of seeds, fertilizers and other inputs; falling groundwater levels; insufficient income from small agriculture; landlessness among Dalits; takeover of commons resources by industry; land alienation among adivasis; land and other property not being in the woman's name; rising costs of health care in urban areas, etc. Climate change impacts are both affected by and worsen the many inequalities in Indian society. Millions of better-off people also live in cities and towns on India's coasts and all over, and will face the effects of storm surges, sea level rise, flooding, and droughts. But it is one of the worst violations of justice that those least responsible for global warming bear its burdens the most.

1. Less rain, yet more intense rain, and more variability: The most widely felt impact across India in recent years has been to rainfall patterns, with increased variability. Over 1901–2012, the southwest/summer monsoon (June–September, from which India gets 75% of its total annual rainfall) has reduced in northern, central, eastern, and northeast India, and the

southern Western Ghats. In central-east India, the reduction is as much as 10–20%.

The distribution of rain within this monsoon season has also gone haywire. Moderate rainfall (50–100 mm of rain a day) has decreased over much of the country. At the same time, extreme rainfall events (more than 150 mm of rain a day) have been getting both more frequent, and three times as frequent over very wide areas, right from Gujarat to the Orissa coast, as compared to the early 1950s. No wonder farmers say that nowadays it does not rain for many days and then a lot of rain falls in a few hours or a couple of days! They first noticed these changes in rainfall 15–20 years ago, but it has worsened over the last 7–8 years.

A key cause of these changes is warming waters of the Indian Ocean, the western Indian Ocean in particular. For complex reasons, the Indian Ocean is warming more than other equatorial oceans, and, oddly, more than India's landmass. This reduces summer monsoon rainfall in regions because of a reduced land sea temperature difference. Ironically, it also causes extreme rainfall because there is more moisture transported following rapid rises in sea surface temperature. Other man-made factors also contribute to an increased variability in rainfall, such as deforestation, urbanization, and increased pollutant particles in the atmosphere.

All of this causes widespread damage to Indian agriculture and water supply. Nowadays, it often rains when it should not and does not rain when it should. Farmers sow crops expecting rains that don't arrive or come late. Or there is intense rain at the time of harvesting or threshing, which affects the standing crops and fodder. More intense rain also damages the topsoil. It causes flooding, and adversely affects people's access to water. Millions of farmers suffered crop damage and losses due to unseasonal rains and hail in successive spring seasons of 2013, 2014, 2015, and most recently in February 2018 across a thousand villages in Maharashtra. In 2015, it devastated crops over 18 million hectares across 15 states, a huge 30% of all rabi acreage, causing losses worth Rs 20,000 crores. It triggered a spate of farmers' suicides.

Droughts have also become more widespread. There's a worrying relentlessness with which agriculture is being hit. Every season in the past 3–4 years has been affected: kharif, rabi, kharif, rabi. If it is drought in one season, it is unseasonal rains in another, intense rains in a third. Farmers are being constantly forced to react. Essential crops in India are still extremely rain-dependent: half the land under rice and wheat is dependent entirely on rainfall. Small and marginal farmers, those in dryland, rain-fed areas and without access to groundwater, poorer households mostly, bear the brunt of this. Often, they tend to be from Dalit or underprivileged caste households, or adivasi communities. And when agriculture gets hit on a huge scale, agricultural workers too suffer loss of earnings. At such times, scant attention is paid to them with no concept of their being compensated.

2. Greater heat stress: Over the last fifty years, heat waves in India have become more intense, frequent, and last for longer, caused partly by a warmer tropical Indian Ocean and drier soils. This makes the soils even drier, has affected the yields of key crops such as wheat and fruits, stresses cows, buffaloes, and other livestock, and damages forests. It has also worsened water problems in many places. Night-time temperatures are also less cool than they used to be, hence offering little relief. Coping with too much heat adds to the stress that urban people face.

The elderly, the very young, and working people are particularly vulnerable to greater heat stress. Workers having to labour in stifling conditions, 12–14 hours a day in industrial areas, is common across India. Those in other occupations are also vulnerable: urban construction workers (often women), agricultural labourers, road-building labourers, miners, and those who sell goods in pushcarts, or work outdoors in cities. In the summer of 2015, over 2,500 excess people died in India in a deadly heat wave worsened by global warming. This deadly impact is going to become more frequent, widespread, and lethal because of extreme heat and humidity in the future.

3. Sea level rise and other effects on coastal people:

Any water that is warmed tends to expand and rise. Coastal communities across India have been facing sea level rise due to warmer oceans for many years. Relative sea level rise in the West Bengal Sunderbans, which includes other factors, is a staggering 8 mm/year. It has meant a slow erosion of their lands, villages, homes, and salination of wells and fields. People repeatedly have had to shift inland, and tens of thousands of people have migrated in a search for livelihood.

No occurrence brought home to me the reality of sea level rise more than the fate of a primary school on Sagar island in the Sunderbans. When a group of us visited four years ago, classes were on in full swing. A few hundred metres from the school stretched a mud embankment, broken in parts. And beyond that, the Bay of Bengal. In December 2017, a senior teacher sent photographs of the school building taken the previous month. It had been completely destroyed by the advancing waters. There is a lesson this school teaches us, for what is unfolding in the Sunderbans today will occur at that rate along thousands of kilometres along our coasts tomorrow. Sea level rise will definitely speed up, due to accelerated melting of the great ice sheets on Greenland and Antarctica.

Global warming has other coastal effects. Fisherpeople say that their going out to sea has become more uncertain because there is no clear pattern any more of rainfall and storms. Sea surface currents are changing in unexpected ways. Wind direction has become unpredictable. The space to do post-catch work, often done by fisherwomen, shrinks as the sea encroaches.

As it is, numerous ports, ultra mega power coal plants, and other projects on the coast in Gujarat, Andhra Pradesh, Tamil Nadu, and elsewhere are damaging traditional occupations, and polluting agriculture, water bodies and local ecosystems. Now climate change adds to this. Rising sea surface temperatures is causing stronger storm surges. The salt water that comes in with storms, and that which seeps into the groundwater harms coastal

agriculture and drinking water sources. Tens of millions of people practice agriculture, fishing, and other livelihoods in fertile, biodiverse stretches along over 7,500 kilometres of India's coasts. They are all vulnerable as global warming's effects intensify.

4. Extreme rainfall events and flooding: On 27 July 2005, 974 mm of rain fell in a single day in Mumbai. Lakhs of people had to wade several kilometres through chest-high water. Well over a thousand people died in the floods, mostly poor residents of North Bombay, as their houses and shanties on slopes collapsed. Some people drowned in their cars as waters rose above them.

In June 2013, a very wide region of Uttarakhand was hit by intense rains, that too for three days. The devastating floods that followed may well prove to be India's worst climate change disaster. The extreme rain burst the wall (moraine) of a mountain lake (Chorabari Taal) just above Kedarnath. Its surging waters rushed downhill, destroying that town and villages below, submerging thousands of tourists, villagers, and workers. The National Disaster Management Authority said 11,000 people may have died. But the death toll could be even higher – the precise number of those who died will never be known – partly because there were so many Nepali and Indian migrant workers from elsewhere on duty then, at the height of the tourist season.

Hundreds of villages were devastated in Uttarkashi, Rudraprayag, Chamoli and Pithoragarh districts, and beyond. Homes were swept away, the standing crop destroyed, fields submerged in river water or mud and debris, animals on which locals depend for manure and milk, drowned. Tourism—on which lakhs of locals and migrant workers depend for jobs and earnings—was hit. Children's schools were damaged. Women in particular were badly affected as they nurture households, cook food, get fodder.

Rainstorms, which occur over very wide areas and contribute to flooding, have increased in frequency and duration (by 15 days) since the early 1950s. Studies suggest these are caused by warmer

seas, and more moisture due to a warmer landmass. Extreme rainfall events certainly seem to be happening regularly nowadays—Uttarakhand in 2013, Srinagar in September 2014, Chennai in December 2015. Kerala in August 2018 is the latest, which received over 40% more than normal rainfall from June to mid-August; 350 people died, with landslides in Idukki and Wayanad districts and numerous towns flooded and homes extensively damaged.

In every case, the societal impacts of intense rains are made worse by chaotic ‘development’ fuelled by the drive for profit—the builder lobby in Mumbai, run-of-the-river projects in Uttarakhand, and buildings shrinking the Pallikaranai wetlands in Chennai. In city and town in India, wetlands and water bodies are being shrunk and built upon. “Who is this ‘development’ benefiting?” is a reasonable question to ask.

5. Droughts in many places: Studies show that there have been significant increases in the area and intensity of droughts in India since the mid-1950s. There are also more droughts of longer periods. Two key reasons are warmer temperatures due to global warming, and excessive warming of the Indian Ocean; it has reduced the temperature difference between India’s landmass and the sea, which is weakening our monsoon. Warming also causes already dry regions to get even less rainfall. But droughts are now happening in regions of India known for good rains—parts of the North East, Jharkhand since 2000, Kerala until the recent floods.

Global warming contributes to intensified droughts in interior regions. Some parts of Bundelkhand in central India (straddling Uttar Pradesh and Madhya Pradesh) have been experiencing droughts for most of the last twenty years. When a team of us visited Bundelkhand in 2009, we saw a complete collapse of agriculture. Large lakes had dried up for the first time, lakhs of agricultural workers, small farmers, poor women were migrating with their entire families. Livestock were being abandoned to a dusty death because of lack of water and fodder.

Survey teams that visited Bundelkhand in 2015 found the same grim conditions prevailing.

Women face the brunt of this. We found old women unable to use the few functioning handpumps because the water levels had plummeted. Patriarchy induces them to eat less when food supply gets hit. Because poor women do all kinds of work inside and outside the house—procuring water, as marginal farmers, getting fodder and wood, as agricultural workers—they are the single largest social group and the worst to be hit by climate change in India.

6. Across the Himalayas: The Hindu Kush Himalayan region – which includes Tibet and Nepal – has warmed by 1.24 degrees C over 1951-2014, about twice as much as India's average rise over the same period. The temperature rise is higher in the Himalaya because as snow melts, the now darker surface absorbs more heat. The rise is even sharper in winters; warmer, shorter winters are being felt all over India but in particular at higher altitudes.

Milder winters and greater warming are causing a change in snowfall patterns, in Kashmir, Ladakh, and Himachal Pradesh, and reduced snow at mid- to high altitudes. Precipitation is happening less as snow and more as rain. Or it snows at the wrong time in the season. Small glaciers are disappearing, and large glaciers melting, both high up and below at their snout. Less snow gravely impacts people's access to water for drinking during the summer months, and irrigation. Rainfall in the northeastern Himalayan states has reduced sharply in the last 15 years. Springs, on which locals depend for drinking, other domestic uses, and irrigation, are drying out. Forest fires are increasing, and there are greater pests in some hill regions.

Other species are affected too. Oak trees, apple trees, vegetables, reptiles, butterflies, birds and other fauna all try to adapt by climbing higher up mountain slopes, looking for temperatures to which they are accustomed. Meadows are shrinking, and alpine species face a risk of extinction. Many alpine

plants and other species are already near mountain tops; how much further can they go?

7. Impacts on Health: Many factors affect health; to isolate climate change is neither easy nor necessary.

But climate change could have a range of direct and indirect effects. The poor face reduced access to food and nutrition, either directly in rural areas when their crops get adversely impacted, or indirectly in urban areas because of the temporary spikes in food prices. This reduced food intake has resulted in increased rates of death and serious illness among the poor in parts of central India in recent years. It is also hitting the urban poor in numerous places.

Diseases such as malaria, dengue, and chikungunya have spread wider, in new areas, higher altitudes, or for a longer duration in the year, as winters get milder in the plains, or mountain places get less chilly. Viruses and bacteria generally flourish in less cold weather.

The increase in the number, area, and duration of heat waves, mentioned above, is causing acute heat stress, disease, and deaths, particularly of the poor and aged, the homeless, and those who work outdoors for long hours. One of the most deadly global warming impacts in future will be large areas across India, indeed across South Asia, becoming uninhabitable. It will become so hot and humid, this combination will interfere with our bodies' capacity to lose heat.

8. Other impacts in urban areas: People in towns and cities are impacted by many of the effects narrated above: warmer daytime temperatures, milder winters, rising food prices. One serious issue for urban people is having to cope with longer and more frequent heat waves, which kills hundreds of people each year. Studies have shown that excess heat affects the urban poor excessively, because of their cramped homes, congested localities, and materials used.

Also, water problems at both ends: by flooding during ...the Indian Context

extreme rainfall (above) as occurred most recently in Kerala, and by droughts. The huge drought in parts of Maharashtra in 2016 resulted in the people of Latur town being supplied water by trains! Even as innumerable other small towns in Marathwada were panting for water. These droughts are accentuating the already unequal distribution of, and access to water in any Indian city.

It is to me deeply worrying that the impacts described above have happened with barely 1 degree Celsius of average warming. We need to realise that these climate impacts are going to **intensify** and **will happen simultaneously**. Sea level rise in one place, drought in another, flooding close by, intense rains It will hit food security, access to water, livelihoods, lands, health, etc of people everywhere. Are we displaying the urgency the situation warrants?

Impacts elsewhere in the world

- **Sea levels** are rising by an average of 3.2 mm a year over the last twenty years
- Rise in '**extreme events**' **all over the world**: floods in Pakistan and the heat wave in Russia in 2010; heat waves in Argentina in 2013; fires in California, the drought that affected parts of Jordan, Lebanon, Israel and Palestine, and the blizzard that killed 43 people including 21 trekkers in Nepal, all in 2014; extreme rains in Wuhan, China in 2016; and the drought in Cape Town in 2018.
- In September 2012, **Arctic sea ice** melted to its lowest area and mass ever; the Arctic is nowadays frequently several degrees above normal, affecting climates in Europe and North America
- **Oceans** have warmed to a depth of 2,000 metres, and even lower
- Of the 800 **Himalayan glaciers** being monitored in China, India and other countries, 95% are melting. Melting is happening at over 20,000 feet altitude

- The Syrian drought of 2007–2010 that may have contributed to the ongoing conflict
- **Food production** is beginning to get hit in some of the poorest countries

Impacts on Other Species

- **In India**, as ocean waters have become warmer, mackerel, oil sardines, and other fish species have moved north along both coasts. Earlier found up to Malabar in Kerala, mackerel have moved 650 kilometres north and can now be found off Gujarat. In the Bay of Bengal, earlier only up to Andhra, they are now found in Orissa's waters. A similar shift of location northwards is happening with river fish in the Ganga.

- Migration of species to higher altitudes in the North Indian mountains, such as oak and apple trees, animal species, vegetables.

- Early or erratic flowering of many plants and trees, such as of mango in Orissa and Karnataka, rhododendrons across the Himalayas, saffron in Kashmir

- change in the timing of spawning of certain fish due to higher sea surface temperature
- Coral bleaching happens soon as sea water temperatures cross 31 degrees Celsius. Bleaching due to higher sea surface temperatures has occurred every summer off the Tamil Nadu coast since 2005
- Slow death on a large scale of cows and other livestock in times of drought; they also face greater heat stress and consequent illnesses

Worldwide, a survey of over 800 published papers covering hundreds of species showed similar effects:

- Species are moving northward, or away from the Equator, towards the poles, towards more suitable temperatures
- The annual migration of birds is happening earlier
- As it gets warmer, mountain species are moving upwards,

but some mountain frog species have gone extinct having nowhere higher to climb

- Some birds are laying their first eggs earlier
- Disruption in timing between lifecycles of predators and prey, and of insect pollinators with flowering plants
- Scientists now believe that up to 40–70% of all species could become extinct because of heat waves, droughts, more acidic oceans, having nowhere further to climb at the top of mountain slopes, and other effects of global warming.

The sceptical view

There are still those who say that yes the Earth is warming, but it is not significant; or, that humans are not primarily responsible, it's part of the Earth's natural cycles; or, that it has happened before, so what's the big deal?

Official data given earlier shows how much warmer India has become over the last three decades. Forget the data, one only needs to open one's eyes to responses in Nature to warming that is happening all over India.

To say it has happened before naturally is true but what matters is the pace at which current changes are happening, and why. Human civilization itself evolved over the last 10,000 years and we are pushing changes that have not happened for millions of years, outside human experience. Ecosystems are able to adapt only when things change slowly. Changes are now happening much faster than ecosystems and species can cope with.

Some people were questioning the basic science because Earth surface warming slowed down for some years after 1998. This happened because most of the excess heat being trapped by greenhouse gases was going into the deeper oceans. This lull in rising surface temperatures ended dramatically, with 2014, 2015, and 2016 successively breaking records as the hottest years ever, since instruments began comprehensively recording temperatures in 1880. If we send more carbon dioxide and other greenhouse gases into the atmosphere every year, they will trap

more heat. This basic physics of global warming has been well established for well over a hundred years.

The urgency of action

The urgency of global warming is because the window to intervene is fast closing. Global warming triggers feedback responses in some ecosystems that in turn cause further warming. For instance, Arctic sea ice has been melting away. Arctic ice acts as a giant mirror, reflecting sunlight. Ice covering a smaller area means that more heat is getting absorbed.

Also, in the Arctic lands, beneath the frozen layer on top, are billions of tonnes of methane. Melting ice will release this methane, causing further warming. This feedback has already been happening for the last ten years. There are other, known climate feedbacks already recorded: more water vapour (traps more heat), warmer soils (release carbon dioxide instead of absorbing it), etc. A current debate is whether the amount of carbon dioxide being absorbed each year by some oceans has stopped increasing. If so, more carbon dioxide will remain in the atmosphere, causing further warming. That would be catastrophic.

Some of these feedbacks have already gone out of hand. For instance, we will soon have Arctic summers with little ice, it can't be stopped. *The urgency to tackle global warming comes from the fact that these feedbacks will happen together on a scale that makes it impossible for humans to prevent extreme warming, of a kind civilization has never experienced.* The urgency is also that some changes in ecosystems cannot be reversed. It has never been greater.

What are the governments doing?

The Indian government: Given the urgency and complexity of these problems, not enough and not quickly enough. About cutting emissions (**mitigation**) the government's position, as stated in India's Nationally Determined Contribution (NDC), is: India will "reduce the emissions intensity of its GDP

by 33%–35% by 2030 from 2005 levels". That is, not less in absolute terms, but reduced emissions per unit of GDP, less than what might have been. Such a target is extremely modest, one that is easily achievable in a modernizing economy. Is that an adequate response to an ecological crisis on a world scale, one which is already hitting India's own people so massively?

Regarding helping people cope with climate impacts or preparing for them (**adaptation**), the 2011 government scheme National Innovations in Climate Resilient Agriculture (NICRA) identified 151 climate-vulnerable villages for a range of interventions, depending on the climate stresses. These include moisture conservation techniques such as mulching, construction of farm ponds, introducing short-duration crop varieties, drought-tolerant varieties, etc. However, a recent analysis finds it is hampered by low participation in selected villages, understaffing, poor integration with other existing programmes, and has worked poorly in most villages.

Thousands of wells and ponds have been dug under the MGNREGA, which boosts adaptation, whether or not that was the intention. However, this important government scheme remains underfunded when it could help crucially in times of drought, flooding, and heat stress. Studies about heat-coping hybrids, saline-resistant crops, and other relevant research are being carried out in agricultural research institutes; it needs to reach farmers everywhere quicker and wider. But Krishi Vikas Kendras are understaffed, agricultural extension services are being withdrawn, just when they are needed the most, as neo-liberalism dictates that welfare and state support be squeezed. Economic and social equity is central for people to adapt and cope with climate change in a more resilient manner. However, most government policies for the last few decades have been pushing society in a more unequal direction, such as the reduction in income taxes on the privileged, and the meagre social sector expenditure.

The National Action Plan on Climate Change (NAPCC) has eight missions—solar, energy efficiency, water, agriculture,

knowledge mission, etc. But in many sectors—water, agriculture, energy—the government’s policy measures have in effect given greater scope for profit by private industry. State Action Plans on Climate Change (SAPCCs) have been drafted in 22 states, but with little consultation with local people, unions or other organizations. The Madhya Pradesh SAPCC was one welcome exception, in the numerous consultations the government organized before drafting it. The Uttarakhand disaster of 2013 showed how poorly prepared the governments are, with rare exceptions, despite having a state action plan in place. When disaster struck, like in the Chennai and Kashmir floods, it is the people who came together and helped each other.

Among the welcome measures listed in India’s NDC document are an expansion of rooftop solar photovoltaic connected to the electricity grid, and an expansion of mass transit public transport. Solar power capacity is slated to grow to 100,000 megawatts (MW) by 2022. The progress so far has been impressive. Our solar capacity is currently little over 23,000 MW (as on 31 July 2018). But unless it is on rooftops (currently just 5% of total capacity), even solar power can be problematic: roughly four acres of land are needed for generating every one megawatt of solar power. The NDC document mentions 25 solar parks, which will take over lots of agricultural land.

This is one key problem with India’s NDC and energy policy in general: an indiscriminate grabbing of energy from all possible areas and forms: a massive expansion of nuclear power (which it calls “environmentally benign”) to 63 gigawatts (GW) by 2032, from 7 GW currently; large hydropower to nearly 100 GW; and even more coal and gas. This indiscriminate expansion is largely aimed at meeting the energy demands and pleasures of the privileged in an increasingly unequal society. As it is, our cities are among the most polluted in the world, causing early or higher death rates of the elderly and of those with respiratory problems.

Meanwhile, private industry continues to profit from the climate crisis: as of January 2016, there were 1,593 Clean Development Mechanism (CDM) projects in India, 90–95% by

the private sector. These companies have been issued 191 million Certified Emission Reduction units (CERs), which they can sell in the carbon credits market as one sells shares, when the price is right.

In general, the economic policies of the last twenty-eight years—cheap flights, easy finance for cars, malls in cities, easy access to ACs, fridges, TVs and other consumer durables, reduced wealth tax on the rich—cause and reflect the deepening inequalities of incomes and wealth. There is a view that the issue of climate change ought not to interfere with India's right to develop. However, we also need to reflect more on how unequal that development has been.

Successive governments continue to hide behind the poor by saying “India's emissions are low,” while grabbing energy from everywhere, and causing displacement of the poor on a huge scale. The current government has been an ecological, social disaster—it has diverted over 40,000 hectares of forest land for commercial projects, cleared 2,000 projects that needed forest and environmental clearances, legalised the destruction of wetlands, made mining approvals easier, etc.

Other governments: For 24 years, governments have been meeting annually at a Conference of the Parties (COP) to discuss chiefly four key areas: emission cuts, adaptation measures, financial help, and technology transfers to developing countries to help them reduce emissions or adapt. The most significant recently was the 21st COP, at Paris in December 2015.

In 1997, at the Kyoto COP, most developed countries agreed to cut emissions by a small amount by 2012 over their 1990 levels. Different countries had slightly different pledges; the overall average cut pledged was only 5.2 per cent over 1990–2012, less than what the science demanded. But since developing countries, including China and India, were not required to sign on, and the US Congress did not ratify the Kyoto Protocol, some of the world's largest emitters were not covered by it. And not just were the target cuts so feeble, the Kyoto Protocol opened the way for

corporations to profit from the crisis, via the Clean Development Mechanism (CDM) and REDD. They are now trying to expand this profit-making via REDD+, by putting a price on the ecological benefits that Nature bestows. This is hardly surprising; capital will try to profit from *anything*. Like we discussed, it's part of its DNA.

We are currently in the second phase of the Kyoto Protocol's commitment period (2013–2020), which is in limbo. The third phase, covered by the Paris Agreement, only starts after 2020. As part of that, each country was to submit its Intended Nationally Determined Contribution to the United Nations. China has pledged to cut its emissions intensity by 60–65% by 2030. The United States had pledged to reduce its emissions—absolute, not relative—by 26–28% by 2025, over its 2005 levels, which is just a 3% reduction over the Kyoto Protocol's 1990 baseline. US President Donald Trump's environment policy measures, such as opening up coal mining areas, and formally withdrawing from the Paris Agreement (as of January 2019, the only country in the world to do so), constitute a bad setback to mitigation efforts, within the US and internationally. But it is the systemic drivers mentioned earlier—the constant efforts to maximize profits and growth—that are the more serious, underlying problem than Trump.

The Paris Agreement mentions limiting warming to “well below 2 degrees C above pre-industrial levels, and pursuing efforts to limit the temperature increase to 1.5 degrees C”. This may be a victory of sorts for all those who have for years pushed for thresholds below 2 degrees C. However, the Paris Agreement has adopted a fragmented approach that disregards what the science is telling us about total reductions needed. Crucially, the present pledges of emission cuts by *all* countries, *even if* they are met, will lead to an average warming of 3 degrees Celsius, way above what is considered safe. It will be disastrous on a colossal scale; human civilization has no experience of those temperatures.

There are rare exceptions among governments. Some of the small island nations, facing the threat of sea level rise, have been

pressurizing big governments to act. Pressured by indigenous peoples who form over half its population, the Bolivian government passed the Law of the Rights of Mother Earth in 2010. It recognised that all living things have rights, including the right to biodiversity without genetic manipulation, the right to water to sustain life, and the right to restoration of ecosystems damaged by human activity. Ecuador put in its Constitution that Nature too has rights just as humans do.

However, most governments represent national elites. They are unable to question the systemic issues of capitalism or class. To expect that government elites would show us the way out, in the absence of people's pressure from below, would be to put our faith in the wrong hands.

What Can We Do?

Work together, on different things, at all levels, and with urgency. Global warming touches on so many areas of life that it enables us to engage through whatever we find meaningful or interests us.

There is a view, ideological in its essence, that technology will solve the problem. To expect that a solution will come from technology alone is not just unrealistic, but also foolhardy, because it encourages us to sit back and do nothing. Technology has its place. For example, we do need to expand rooftop solar power, and improved energy efficiencies of various kinds. But the way forward is social, political change, combined with appropriate technologies, not technology in isolation.

What follows are some suggestions of ways forward. They are obviously by no means exhaustive. However, the urgency of global warming does not allow us the luxury of time.

Individual efforts

The market is taking over the minds of many people. Not just in the obvious symptom of unnecessary consumption—gadgets become a way we present ourselves—but also in influencing our interactions with other people and with the

natural world. Resisting this mental loss of freedom is both an essential first step and a constant battle.

Regarding specific individual measures, try to identify your largest carbon-emitting activity and minimize it. This suggestion applies *only* to the well-off. It's usually flying. If this applies to you, minimise flying to essential situations and emergencies. Besides, reduce the use of energy-guzzling gadgets like ACs; use buses and other public transport, buy local produce, etc. These individual lifestyle choices are linked to favourable public policies that enable them, such as cycle paths, bus transport that is safer for women, etc.

At the household level, for those who can afford it, measures that help include installing rooftop solar panels and rainwater harvesting. Rooftop solar connected to the electricity grid has just begun in Delhi. Growing vegetables in your verandah if you have one, or on the terrace of your house or housing complex is not just healthier, it also reduces your food's carbon footprint. Urban agriculture is practised in Delhi, Bangalore and a few other cities in India but is largely restricted to the well-off. Incidentally, Cuban towns have done this for twenty-five years.

Collective ways forward

Individual actions, though relevant, are not sufficient. The usefulness of individual action is exaggerated by elites and the media. They ask us to turn off our lights on Earth Day for one hour, or change our light bulbs; we think we have done enough. We then tend to avoid questioning the systemic issues at the root of global warming and a range of other ecological problems. Social and political change usually happens collectively, when many people realise that something is wrong and needs to be changed or improved, and come together to do something about it.

1. Work needed in your community or town: What would you like your town or city to be like? Any city in which we live has a number of issues that connect with global warming. In Delhi, for example, there was a campaign to expand **rooftop**

solar power. Some organizations have been demanding that public transport policy be expanded beyond the Aam Aadmi Party's odd-even plan. That more BRT bus corridors—which reserve one-third the road space for public buses and emergency vehicles—be built. They have also asked for a **transport system** that stops focusing on car users alone, and serves all, including cyclists, pedestrians, and bus users. Many towns, even a state capital like Dehradun, do not have a public transport system to speak of, and run on 'Vikrams'. Metros are expanding in some cities but are priced too high, which denies access to working people, whereas access to metros ought to be made universal through cheap monthly passes, like in Mumbai's trains.

In Mumbai itself, there is an ongoing citizens' campaign (called 'Aamchi Mumbai, Aamchi BEST') for the past couple of years against the privatization of its famous BEST bus service, and supporting bus workers' rights. This group published *A People's Plan for BEST* [in August 2018], which says that "frequent, affordable, speedy, decent, and safe public transport is a basic right of all citizens". They demand that fares need to be low for buses to be accessible to all, and that there be more buses with a wider reach in different parts of the city.

Water is a key area of intervention in a climate-changed context. Work around water is possible at four levels. Reviving traditional or older **water bodies** in your locality—bavadis/stepwells, ponds, lakes, older canals, streams. But as a first step, we need to know where they are. Identifying such water bodies is something students can do in urban areas, and farmers' and other organizations elsewhere. Or you can do along with others in your locality or community. Two, pressurizing local authorities to create the infrastructure for **rainwater harvesting** along roads and public places, which helps falling groundwater levels. Along with this, arguing for an **equitable distribution** of water, so that every single person or household can access a minimum daily volume for a decent living. Regenerating traditional water bodies, building new water harvesting structures, planting trees, cleaning existing water bodies, re-laying the water distribution network

more equitably have multiple benefits: improving the groundwater situation, reducing waste, using less energy, and ensuring water for all. It has the added benefit of creating jobs on a large scale so unions and workers would be interested. Finally, the deluge in Chennai in December 2015 and Mumbai in June 2005 tell us how **encroachments** on wetlands, floodplains of rivers, and water bodies prove disastrous in the long run, and should be opposed in every town as India urbanizes. Such as the ongoing campaign to preserve the Ennore Creek and wetlands in Chennai. All of this suggests we need to pressurize both the municipal authorities, and elected politicians who are supposed to represent our interests.

2. To understand and strengthen **a people's perspective on climate change**, one needs to chat with people, both in urban and rural areas, about how climate change is affecting their lives. What impacts do they face, what they think about it, what they are doing (or not doing) about it.

Local farmers and other communities are trying to adapt in different ways: changing the mix of crops, the timing of their crop cycle, reverting to traditional seeds, adopting the system of rice intensification (SRI), digging small ponds, trying to improve soil health, trying to revive older water bodies, etc. To know what responses work is particularly important since adaptation that has been successful in one place can be replicated elsewhere in similar conditions.

This work can be done particularly by groups of students, young people, farmers' collectives, and other organizations. Climate impacts on urban dwellers include flooding, water shortages, heat stress, adverse health impacts, and higher food prices. Understanding the issue from a class perspective also helps us see through unsatisfactory frameworks that are constantly thrown at us. A gendered perspective on climate change is particularly important and has hardly been developed in India, for which students can get in touch with collectives that organize or work with women. All of this takes the issue away from abstract

science, to where it should be located: in people's lives and livelihoods.

3. In colleges: In case you don't already have a student group or union in your college, form one. It could be an environmental group, Nature group, or a student collective. Begin by talking to friends and anyone else interested, call for a first meeting to discuss the idea, set up a WhatsApp group if enough students have a smartphone, put up posters about it in college. Perhaps you could start off by having a discussion or film screenings. Supportive teachers can help.

Small but specific actions are a good way to get going. For instance, college students could measure the space available on the roofs of their college buildings, and calculate how many solar panels can be installed there. Then approach the relevant department office or the MNRE website for installing solar panels. The same goes for having water harvesting facilities in college. You would need to pressurize the college administration and perhaps the local government authorities to implement these measures. Push for better and safer bus and other public transport for students near your college or university. For all of this, students getting together collectively is essential. After your group gets going, contact friends in other colleges and help start the process there. Once a group forms, sustaining it becomes important.

4. Demanding renewable, less harmful, decentralized energy choices: Nuclear power has obvious dangers (though being wrongly promoted by the government and some individuals abroad as a solution to climate change). Coal is the dirtiest fuel and the source of life-threatening pollutants and toxins. There is widespread opposition to large dams in many regions. So we are *against* a lot; what are we *for*?

We need a **faster transition to cleaner energy sources**. Some unions and other collectives in India—and elsewhere—have begun to engage with the question of a transition away from fossil

fuels. Solar power, whose unit price is dropping, and wind power, which is expanding, are the most promising. Solar power has the potential to be used in cooking, heating water, and other basic uses. For electricity, it is ideal as a decentralized application (rooftop photovoltaic). These are badly needed in urban areas, from where much of the carbon emissions come.

In recent years, investment in electricity worldwide from renewable energy sources has been double investment in power from fossil fuels. Power from renewable energy sources contributed 24% of electricity generated in 2016, but much of it is hydropower (17%), wind is small (4%), and solar tiny (1%). Encouraging as the recent expansion of solar and wind energy may seem, or even be, the share of all renewables in total energy consumption is still small—just 3% worldwide in 2015, about 8% if one includes hydropower. For carbon emissions to fall, as the science demands, it is not enough that renewable energy expands; coal, oil, and gas use should reduce overall. While coal use has been flattening worldwide, the use of oil and gas continue to rise.

A faster transition won't happen without pressurizing governments to move away from subsidising and promoting coal and other fossil fuels, and strongly support solar and wind. The German example is instructive: over the last decade, solar power capacity expanded there from a few hundred to over 30,000 megawatts. This was helped by favourable policy, but that was enacted because there is a huge environmental Green movement of workers, students, and other ordinary citizens who demanded a halt to nuclear power and greater support for renewables. Half of Germany's new renewable energy has been organized by citizen groups, farmers, and newly-formed energy cooperatives.

Even renewables have social costs. Large solar parks take up a lot of agricultural land, over 4 acres for every megawatt capacity. The only way we can have a socially less harmful energy transition is by also restricting energy demands to first meeting people's basic needs. We need to have a steep carbon tax. A progressive carbon tax has recently been proposed for India, the revenues from which are then distributed to the poor through

universal access to energy and public transport. Ensure the reduction of wasteful use (which happens only by the well-off). Otherwise we end up recklessly trying to grab all kinds of energy from everywhere, which is what current policy seems to be, which is harmful to other people and species.

5. All over India, **struggles** have intensified against displacement and for local community control over commons resources like forests, agricultural land, wetlands, rivers, and the sea. These are being waged against mining projects, coal power plants, aluminium projects, nuclear plants, and most recently against land being taken for 18 vast industrial belts, such as the Delhi–Mumbai Industrial Corridor.

Local residents who resist have been agitated by the loss of livelihoods, control over resources and agricultural lands, and sometimes by health concerns. Their immediate motive is not climate change, but connects with it in different ways. These include struggles about energy choices: resistance to coal mining and coal power plants have exploded in a number of places such as Mahan, Chandrapur, Sompeta and Kakrapalli, where huge ultra mega power projects are being built or planned. Other struggles have been waged in Kudankulam (nuclear), Jaitapur (nuclear), the Narmada valley (large hydro), and Polavaram (hydro). There are movements against dams in the Himalayan states, from Himachal Pradesh in the northwest to Arunachal Pradesh in the Northeast.

By preserving wetlands or forests—such as against POSCO or in Niyamgiri—these people's struggles not just preserve important local ecologies, but also help combat global warming by retaining carbon sinks. At the heart of these struggles are questions of justice and what an appropriate development trajectory might be, questions at the core of global warming.

Over the years, students and other youth have related in many ways: joined these movements directly; some have joined progressive organizations or parties; others formed support organizations for specific struggles, yet others have visited those places and published reports or campaigned in different ways.

A brief mention of **campaigns outside India**, to give a sense of the global nature of both the problem and the response: struggles to resist the extraction and burning of fossil fuels, particularly coal and oil, have intensified worldwide over the past three years. These include vibrant resistance to the Rampal coal power plant on the edge of the Bangaldesh Sunderbans, the Keystone and Dakota Access pipelines in North America, and Adani's Carmichael coal mine in Australia. Protests are being carried out in many countries simultaneously at sites where coal is being mined and oil extracted, or in front of offices of their financial backers, in a Break Free from Fossil Fuel campaign. Google it, or check out the website of 350.org. A peaceful mass civil disobedience campaign organized by Extinction Rebellion and demanding deep carbon emission cuts has been carrying on in the UK since November 2018.

Over the last few years, youth have led campaigns to pressurize institutions to withdraw their investments from fossil fuels. Over five hundred entities—including pension funds, government organizations, universities and colleges, and wealthy foundations—with assets totalling 3,400,000,000,000 dollars have committed to withdraw their money from fossil fuels investment worldwide. The list has about thirty educational institutions thus far, including the London School of Economics, SOAS, and Oxford University.

6. Challenging Capitalism: By targeting fossil fuel corporations, the climate justice movement has put a face to the enemy. But the crux, and the difficulty, lies in challenging capital's logic itself, which is one of maximizing profit and endless accumulation for more profit. That accumulation is brutal—in its history of colonialism, violent cornering of resources, profiting from Nature, resource wars, overexploitation of workers, sexual assault on women, the murder of key organizers, repressive laws. Working against global warming means challenging the system, in whatever work we do. The problem is that whereas political

alternatives to capitalism exist, the difficulty lies in evolving *economic alternatives on the scale necessary*.

Global warming and other ecological crises have lent renewed urgency to a number of questions that some had already been asking for years: do we really need high economic growth? The media and politicians are obsessed with growth. But where does this growth come from? Does it result in quality work, large-scale employment, and a living wage? Who does ‘development’ actually benefit? High economic growth has mostly resulted in contractual, insecure, stressful, and poorly paid jobs in the last twenty years in India. Rather than blindly accept ‘growth’ as a mantra, I would argue for a more equitable development trajectory that focuses on providing basic goods and services that most people need to improve the quality of their daily lives. As people’s lives improve, they will consume a bit more, and low but more sustainable growth will happen automatically.

Ecological concerns have to be a part of our politics or worldview. Much criticism has rightly been levelled against 20th century Left practice—its lack of democracy; the primacy it gave to technology; its industrial scale, and ecological destruction that ensued. In this, they mirrored capitalist relations with Nature. Progressive politics cannot henceforth remain blind to these issues.

Ecological concerns, or local peoples’ collective relationship with what Nature provides, have been integral to a number of movements in recent times—Niyamgiri, Gandhamardhan, Jaitapur—both in India and elsewhere. Global warming makes that an issue for us all. Whichever of these elements of Nature we may relate to—the seas, rivers, forests, the hills, birds, cows, fish, other species large and small—they are all being affected. This urges us to think more deeply about our relationship with the natural world, and renders greater urgency in tackling global warming.

Equity is at the core of ways forward. In the context of global warming, there are at least four aspects to equity: one, equity

between people, which is linked to our development trajectory, and would include making small agriculture viable, land distribution, female control over land, and expanding workers' rights. Two, improving the capacity of people to cope with the impacts of climate change. Coping is not merely reacting after the event, but also preparing for and cushioning impacts, reducing risk before an adverse climate impact hits.

Three, equity between generations. Future generations also have a right to common resources, to forests, to groundwater, to minerals, to rivers, to marine resources, etc, as much as we do. But how far ahead are we willing to think? What does 'sustainable development' mean in an economy that is constantly growing? How can we live sustainably for the future if we so deeply valorize growth and consumption?

Finally, equity between species. We need to discard an anthropocentric worldview that focuses on human beings, and conflicts between humans alone. Other species have as much a right to the commons, to energy, to rivers, to the forests, as we do. Human beings are only one among 1.7 million known species on this planet. Ecosystems are intertwined, life is a web, and we need to preserve that web and its interconnections better.

Finally, global warming is urging, but also enabling us to think about a number of issues in an interconnected manner—energy, water, consumption, transport, agriculture, what we would like our town to be like. The picture may seem bleak, and, without doubt, we need to think and act with urgency. But history teaches us that positive social change happens when people come and work together, and therein lies hope for the future.

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- For regular reportage on developments, politics, climate science and campaigns, see the Guardian newspaper, at <https://www.theguardian.com/environment/climate-change>.

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